

### Practice Problems 3.7.12 Honors Physics

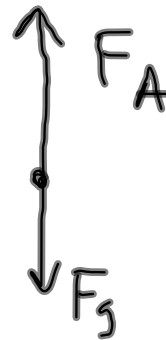
A person holds a plastic grocery bag that has a mass of 6 kg. If the person accelerates the bag upwards at 3 m/s/s, what is the force on the handles of the bag?

1-D y-direction

Picture:



FBD:



$$\sum \bar{F}_y = m \bar{a}_y \quad a_y = 3 \text{ m/s}^2$$

$$F_A - F_g = ma_y$$

$$F_A = F_g + ma_y$$

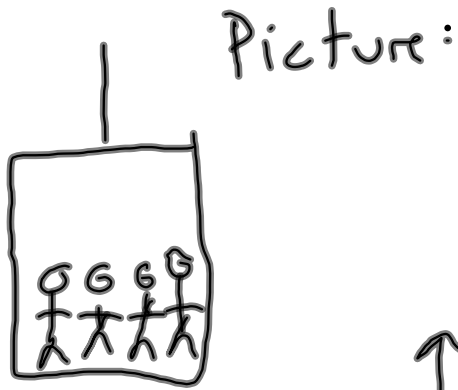
$$= m a_g + m a_y$$

$$= (6 \text{ kg})(9.8 \text{ m/s}^2) + (6 \text{ kg})(3 \text{ m/s}^2)$$

$$= 76.8 \text{ N}$$

### Practice Problems 3.7.12 Honors Physics

An elevator is filled with people, and its combined mass is 4200 kg. If the elevator is accelerating downwards at 1.2 m/s/s, what is the tension on the cable?



FBD:



$$\sum \bar{F}_y = m \bar{a}_y \quad a_y = -1.2 \text{ m/s}^2$$

$$F_T - F_g = m a_y$$

$$F_T = F_g + m a_y$$

$$= m a_g + m a_y$$

$$= (4200 \text{ kg})(9.8 \text{ m/s}^2) + (4200 \text{ kg})(-1.2 \text{ m/s}^2)$$

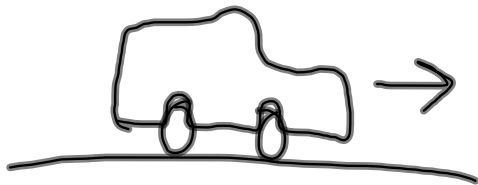
$$= 36120 \text{ N}$$

### Practice Problems 3.7.12 Honors Physics

A car is traveling along a road at a constant velocity. The applied force necessary to keep it at a constant velocity is 100 N and the force of friction acting on the tires is 30 N. Find the force of air resistance acting on the car.

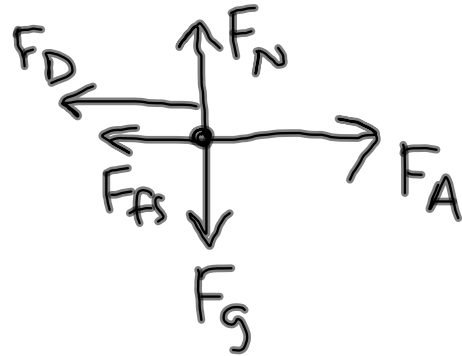
1-D x-direction

Picture:



→ +

FBD:



$F_D$  = drag force  
(air resistance)

$$\sum \vec{F}_x = m \vec{a}_x = \emptyset$$

$$F_A - F_{fs} - F_D = \emptyset$$

$$F_D = F_A - F_{fs}$$

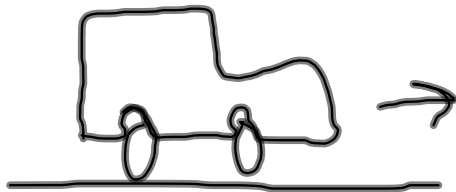
$$= 100 \text{ N} - 30 \text{ N}$$

$$= 70 \text{ N}$$

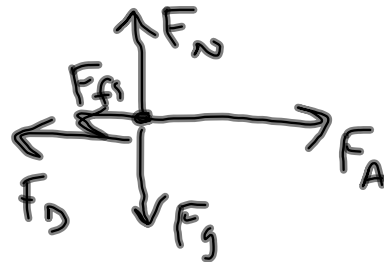
### Practice Problems 3.7.12 Honors Physics

A car of mass 1000 kg is accelerating at 6 m/s/s to the right with an applied force. If the force of air resistance is 300 N and the force of friction is 45 N, what is the applied force on the car from the engine?

Picture:



FBD:



$$\Sigma \vec{F}_x = m\vec{a}_x$$

$$F_A - F_D - F_{fs} = ma_x$$

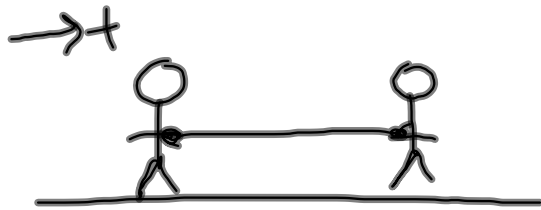
$$F_A = F_D + F_{fs} + ma_x$$

$$= 300 \text{ N} + 45 \text{ N} + (1000 \text{ kg})(6 \text{ m/s}^2)$$

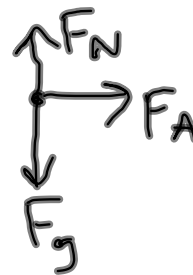
$$= 6345 \text{ N}$$

### Practice Problems 3.7.12 Honors Physics

Two people are standing on a frictionless surface, and they are attached by a rope. When one person with a mass of 75 kg pulls on the rope, the person accelerate at 3.3 m/s/s. What is the acceleration of the other person if the second person has a mass of 99 kg?



FBD 1:



FBD 2:



$$\begin{aligned} F_A &= m_1 a_1 \\ &= (75 \text{ kg})(3.3 \text{ m/s}^2) \\ &= 248 \text{ N} \end{aligned}$$

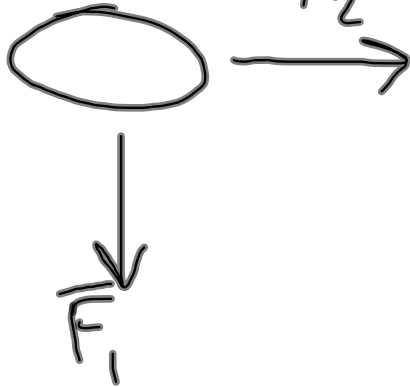
$$-F_A = m_2 a_2$$

$$a_2 = \frac{-F_A}{m_2} = \frac{248 \text{ N}}{99 \text{ kg}} = -2.5 \text{ m/s}^2$$

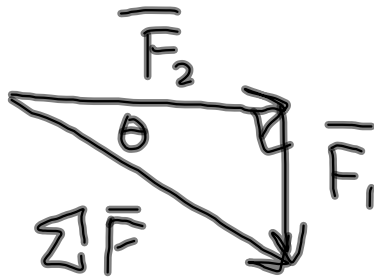
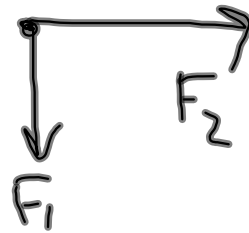
### Practice Problems 3.7.12 Honors Physics

An object has a mass of 10 kg, and is struck with two forces. One force is 18 N south, and the other force is 31 N east. What is the acceleration of the object (magnitude, direction, angle)?

Picture:



FBD:



$$\Sigma \vec{F} = 35.9 \text{ N} @ 30.1^\circ \text{ S of E}$$

$$\vec{a} = 3.51 \text{ m/s}^2 @ 30.1^\circ \text{ S of E}$$

$$\Sigma \vec{F} = m\vec{a}$$

$$a = \frac{\Sigma F}{m}$$